



Page 52-57

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Assessing Human Habitability on Mars: Shibastra C Theory.

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Abstract-

The possibility of human life on Mars hinges on understanding the planet's habitability. I introduce the Shibastra C Theory, my another invented novel theory, a quantitative framework assessing factors like environment, atmosphere, water, temperature, radiation, distance from Earth and gravity. By applying Shibastra C to Mars yields a score of ≈ 0.144 , indicating significant challenges for human habitation. This study explores implications for future Mars missions and potential human settlements.

Introduction-

Mars has long fascinated humanity as a potential destination for exploration and settlement. But with NASA's Perseverance rover and SpaceX's Starship initiatives,

understanding Martian habitability is crucial. The Shibastra C Theory integrates key factors influencing human survival on Mars. By sources indicate Mars' environment is harsh, with thin atmosphere, low water availability and high radiation. The planet's surface temperature ranges from -125°C to 20°C , making it one of the most inhospitable places in the solar system. However, evidence of ancient water on Mars suggests it might've been more hospitable in the past. The discovery of water ice at the poles and potential subsurface lakes further fuels interest in Martian exploration.

Mars' atmosphere is 95% CO_2 , with pressure about 1% of Earth's, posing significant challenges for human respiration and liquid water stability. Radiation exposure is another major concern, with Mars' thin atmosphere offering little shielding against cosmic rays. Gravity on Mars is about 38% of Earth's, with potential implications for human health and mobility. Understanding these factors is crucial for planning sustainable human missions to Mars.

The Red Planet's geology reveals clues about its past climate and potential for life. NASA's Curiosity rover has found evidence of ancient lakes and rivers, suggesting Mars might've had conditions suitable for microbial life. ESA's Mars Express and NASA's Mars Reconnaissance Orbiter have mapped water ice and methane, essential for assessing habitability. As humanity eyes Mars for future exploration and potential settlement, understanding the planet's challenges is key.

Methods of Prediction-

The Shibastra C Index is calculated as $\text{MHI} = \text{Mars Habitability Index}$

$$\text{MHI} = (E \times A \times W \times T \times R) / (D \times G)$$

Where:

- E: Environmental adaptability (0-1)
- A: Atmospheric suitability (0-1)
- W: Water availability (0-1)
- T: Temperature range (0-1)
- R: Radiation resistance (0-1)
- D: Distance from Earth (normalized)
- G: Gravitational impact (0-1)

Parameter Breakdown-

1. Environmental adaptability (E): Assesses terrain suitability, geological stability, and potential hazards like dust storms. Mars' $E \approx 0.8$ due to varied terrain and occasional dust storms.
2. Atmospheric suitability (A): Considers pressure, composition (CO_2 , O_2 , N_2),

and breathability. Mars' A ≈ 0.4 due to thin atmosphere (1% of Earth's) and mostly CO₂.

3. Water availability (W): Evaluates presence of water ice, subsurface water, and potential for extraction. Mars' W ≈ 0.6 due to polar ice and possible subsurface lakes.

4. Temperature range (T): Considers habitability in terms of temperature extremes (-125°C to 20°C). Mars' T ≈ 0.5 due to cold conditions.

5. Radiation resistance (R): Assesses protection against cosmic and solar radiation. Mars' R ≈ 0.3 due to thin atmosphere and lack of magnetic field.

6. Distance from Earth (D): Normalized factor affecting communication, transport, and support. Mars' D ≈ 0.5 (average distance ~ 225 million km).

7. Gravitational impact (G): Considers effects of 38% Earth's gravity on human health. Mars' G ≈ 0.4 .

Calculation for Mars-

- E: 0.8
- A: 0.4
- W: 0.6
- T: 0.5
- R: 0.3
- D: 0.5
- G: 0.4

$$\text{MHI} \approx (0.8 \times 0.4 \times 0.6 \times 0.5 \times 0.3) / (0.5 \times 0.4) \approx 0.144$$

Sensitivity Analysis-

- Increasing A (atmospheric processing) to 0.8: MHI ≈ 0.288
- Improving R (radiation shielding) to 0.6: MHI ≈ 0.288
- Subsurface habitats (increasing E to 0.9, W to 0.8): MHI ≈ 0.345

The Shibastra C Theory provides a framework for assessing habitability based on these key factors. Future work could refine parameters or include additional factors like resource availability.

Results and Discussion-

The Shibastra C score for Mars is ≈ 0.144 , indicating significant challenges for human habitation without substantial infrastructure. Key limitations-

- Thin atmosphere (A=0.4): Insufficient pressure and CO₂-dominated composition pose major hurdles for human respiration and liquid water stability.
- High radiation exposure (R=0.3)- Mars' thin atmosphere offers little shielding

against cosmic rays, increasing risk for humans and electronics.

- Cold temperatures ($T=0.5$): Temperatures range from -125°C to 20°C , requiring robust insulation and heating systems.

Implications-

1. Atmospheric Processing- Increasing A (e.g., terraforming or habitat pressurization) could boost MHI. Technologies like CO_2 processing or O_2 generation might be essential.
2. Radiation Shielding- Improving R (e.g. subsurface habitats, radiation shields) is critical for long term human safety.
3. Subsurface Habitats- Enhancing E (environmental adaptability) and W (water access) by using subsurface resources could improve habitability.
4. Gravity Mitigation- Mars' 38% Earth gravity ($G=0.4$) might impact human health long term; countermeasures like rotation based artificial gravity could be needed.

Scenario Analysis-

- Minimal Adaptation: $\text{MHI} \approx 0.144$ suggests short term missions face extreme challenges.
- Moderate Infrastructure- With $A=0.6$, $R=0.5$, $E=0.9$ (subsurface habitats), $\text{MHI} \approx 0.36$, enabling potential human presence.
- Advanced Tech (Terraforming-like): $A=0.8$, $R=0.6$, $W=0.8$; $\text{MHI} \approx 0.6$, suggesting possible long-term habitability.

Challenges and Opportunities-

- Dust Storms- Mars' dust storms could impact solar power and operations.
- ISRU (In-Situ Resource Utilization): Using Mars' water ice for fuel, oxygen and life support could boost sustainability.
- Health Risks- Radiation, gravity effects and isolation need addressing for human missions.

The Shibastra C Theory highlights Mars' habitability challenges but also guides tech development and mission planning. Future work could refine parameters or model specific mission scenarios.

Conclusion-

The Shibastra C Theory provides a framework for assessing human life possibilities on Mars. With $\text{MHI} \approx 0.144$, significant technological and infrastructural advancements are needed for sustainable human presence. Future

research should focus on mitigating Mars' environmental challenges.

References-

1. NASA's Mars Exploration Program. (n.d.). NASA.
2. ESA's Mars Express. (n.d.). European Space Agency.
3. Mars Science Laboratory (Curiosity Rover). (n.d.). NASA.
4. Astrobiology Journal. (n.d.). Astrobiology.
5. Mars Habitability Conference. (2020). Conference Proceedings.
6. NASA's Perseverance Rover Mission. (n.d.). NASA.
7. SpaceX's Starship Program. (n.d.). SpaceX.
8. Nature Geoscience. (2019). Mars' atmosphere and climate.
9. Science Magazine: Mars Environment. (2020). Mars' harsh environment.
10. Journal of Geophysical Research - Planets. (2018). Mars' geology and habitability.
11. Mars Climate Evolution. (n.d.). NASA.
12. NASA's Curiosity Rover Findings (2012-2020). NASA.
13. ESA's Mars Express Findings. (n.d.). European Space Agency.
14. NASA's Mars Reconnaissance Orbiter. (n.d.). NASA.
15. Science Magazine: Mars Water Evidence. (2018). Water on Mars.
16. Mars Atmosphere Loss. (n.d.). ESA.
17. Radiation on Mars. (n.d.). NASA.
18. Effects of Mars Gravity. (n.d.). NASA.
19. Curiosity Rover Discoveries. (n.d.). NASA.
20. Mars Express: Water Ice. (n.d.). ESA.

21. Paul Roy, Shibbanjan. (2026). Tardigrade Survival in Extreme Environments: Proxima Centauri b, Neptune and Pluto by using Shibastra theory.

22. Paul Roy, Shibbanjan. (2026). The New Mathematical Discovery of Proxima Centauri B by Shibastra Theory.

23. Paul Roy, Shibbanjan. (2026). Applying Shibastra Theory to Uranus and Neptune.

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